Scattering database of oriented dust particles with realistic shapes and sizes

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Dust orientation is an ongoing investigation in recent years [1]. Its potential proof will be a paradigm shift for dust remote sensing, invalidating the currently used simplifications of randomly-oriented particles. For the effective monitoring of the phenomenon we constructed a new scattering database that takes into account realistic-shaped oriented dust particles and a size range that includes most of the coarse mode of dust. In particular, we have used the irregular shapes of Gasteiger *et al*. [2], a size parameter range of 0.01 – 60 and four refractive indices with values of 1.48 – 1.6 + i0 – 0.002. The scattering calculations were performed with the Amsterdam Discrete Dipole Approximation (ADDA) [3] using ~50M CPU core hours on High Performance Computing (HPC) systems.

Currently, there is no complete solution for calculating the scattering properties of the whole range of dust sizes, shapes and refractive indices. For size parameters exceeding 60 – 70, ADDA calculations are challenging even for HPC machines, due to their high computational cost [3]. For this reason we investigate the applicability of the much faster Physical Optics (PO) approximation [4] for dust particles with faceted shapes. We compare the PO scattering calculations with ADDA calculations and we present here the issues and perspectives of this coupling in formulating a complete scattering database for oriented dust.

References

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Preferred mode of presentation: Oral/Poster